CLAIMS

1. A light source apparatus comprising:

light generating means;

a first concave mirror of collecting a part of light radiated from the light generating means; and

a second concave mirror of collecting another part of the light radiated from the light generating means not collected by the first concave mirror and reflecting it on the first concave mirror,

wherein a reflection plane of the first concave mirror and a reflection plane of the second concave mirror are in a form of non-rotation symmetry to a reference axis connecting a source of luminescence of the light generating means to a focus of the light collected by the first concave mirror respectively;

a distance between the reflection plane of the second concave mirror and the source of luminescence is shorter than the distance between the source of luminescence and the focus of the light collected by the first concave mirror; and

a part of the reflection plane of the first concave mirror is formed around the reference axis.

2. The light source apparatus according to claim 1, wherein the first concave mirror has one or a plurality of quadratic surfaces as the reflection plane.

3. The light source apparatus according to claim 2, wherein the quadratic surface of the first concave mirror is a part of an ellipsoidal surface, and one of the focuses of the ellipsoidal surface substantially coincides with the source of luminescence of the light generating means while the other coincides with the focus of the light collected by the first concave mirror.

4. The light source apparatus according to claim 1, wherein the second concave mirror has one or a plurality of quadratic surfaces as the reflection plane.

5. The light source apparatus according to claim 4, wherein the quadratic surfaces of the second concave mirror are a part of a spherical surface and a center of the spherical surface substantially coincides with the source of luminescence of the light generating means.

6. The light source apparatus according to claim 1, wherein the reflection plane of the first concave mirror

is located closer to the source of luminescence than the reflection plane of the second concave mirror; and

the following relations are satisfied if, when a focusing angle of the first concave mirror is divided in two by a plane including the reference axis, a larger angle is α, a smaller angle is β, a maximum angle of the light radiated from the light generating means to the first concave mirror and the second concave mirror is γ, and the focusing angle of the second concave mirror is θ:

(Formula 1)

$$\alpha > \beta > 0$$

(Formula 2)

$$\alpha + \beta \geq 180 \text{ degrees}$$

(Formula 3)

$$0 < \theta \leq \gamma - \beta.$$

7. The light source apparatus according to claim 1, wherein the reflection plane of the second concave mirror is located closer to the source of luminescence than the reflection plane of the first concave mirror; and

the following relations are satisfied if, when a focusing angle of the first concave mirror is divided in two by a plane including the reference axis, a larger angle is α, a smaller angle is β, a maximum angle of the

light radiated from the light generating means to the first concave mirror and the second concave mirror is γ, and the focusing angle of the second concave mirror is θ:

(Formula 1)

$\alpha > \beta > 0$

(Formula 2)

$\alpha + \beta \geq 180$ degrees

(Formula 4)

$0 < \theta \leq 180$ degrees.

8. The light source apparatus according to claim 7, wherein the second concave mirror is placed in luminous fluxes formed by the first concave mirror.

9. The light source apparatus according to claim 1, wherein

the light generating means is a lamp having a vessel body of accommodating the source of luminescence;

the vessel body has a spherical vessel portion of transmitting radiation light from the source of luminescence and a pair of ends projecting from the spherical vessel portion; and

the pair of ends is provided around the reference axis.

10. The light source apparatus according to claim 9, wherein the spherical vessel portion has a first opposed plane opposed to the reflection plane of the first concave mirror and a second opposed plane opposed to the reflection plane of the first concave mirror and the reflection plane of the second concave mirror; and

the part of the reflection plane of the first concave mirror is at least opposed to the second opposed plane.

11. A lighting apparatus comprising:

the light source apparatus according to claim 1; and

lens means placed at a position optically connecting with the focus of the light collected by the first concave mirror of the light source apparatus and converting the light emitted from the light source apparatus substantially to parallel light.

12. The lighting apparatus according to claim 11, wherein the lens means is a rod integrator.

13. The lighting apparatus according to claim 11, wherein the lens means is a lens array.

14. The lighting apparatus according to claim 11, wherein there are a plurality of the light source apparatuses

placed so that the respective reference axes thereof coincide in the same plane; and

it further comprises light guiding means of guiding the light emitted from the plurality of light source apparatus to the lens means.

15. The lighting apparatus according to claim 11, wherein the plurality of light source apparatus are placed so that the respective reference axes thereof intersect at one point in space; and

the lens means is provided at a position corresponding to the one point.

16. The lighting apparatus according to claim 15, wherein the plurality of light source apparatus are placed so that the second concave mirrors are mutually opposed.

17. The lighting apparatus according to claim 15, wherein the plurality of light source apparatus are placed so that the first concave mirrors are mutually opposed.

18. A projection display apparatus comprising:

the lighting apparatus according to claim 11;

a light modulation device placed at a position optically connecting with the lighting apparatus and modulating the light to form an optical image; and

a projection lens of projecting the optical image.